Economic Effects of Increased Ethanol Use in Montana

Montana Department of Environmental Quality
Air, Energy and Pollution Prevention Bureau

The use of ethanol blend gasoline is increasing rapidly in Western states and in the U.S. as a whole. Reasons for this include federal and state-level incentives, the improving economics of ethanol production, the increasing number of states enacting restrictions on methyl tertiary butyl ether (MTBE), and the passage of the federal Renewable Fuel Standards in 2005. This paper describes possible economic effects of increased use of fuel ethanol in Montana's gasoline markets, including the effects of building the first ethanol plant in-state. The economic effects are described in this paper for four categories: 1. Effects on the gasoline consumer, 2. Effects on in-state gasoline refining and retail operations, 3. Effects of an in-state ethanol production plant on local economies and farmers; and 4. Effects of indirect benefits to Montana from increased ethanol usage.

Current Ethanol and Gasoline Consumption and Production in Montana

Ethanol blend gasoline makes up a small percent of today's total market share in Montana. In FY 2005 and FY 2006, just over 30 million gallons of ethanol blended gasoline were sold in Montana, accounting for about 6 percent of the 500 million or so total gallons of gasoline sold in Montana in each of those two years (Montana Dept of Transportation (MDT), FY 2005 and 2006 tax reports)[1]. Six percent ethanol blend of all gasoline sold is the highest level of penetration ever in Montana's gasoline market. By comparison, over 30 percent of the nation's gasoline is blended with ethanol, largely due to air quality requirements[2]. This 30 million gallons of ethanol blended gasoline consumed in Montana used about 3.3 million and 3.8 million gallons of fuel ethanol total—all of that imported from other state.

Ethanol production on a national basis has now reached more than five billion gallons. The passage of the federal Renewable Fuel Standards in 2005, along with the phase out of MTBE, is driving a surge of national ethanol production expansion. In neighboring North Dakota, ethanol-blend use increased by 150 percent between 2001 and 2003, a change in total market share from 12 percent in January 2001 to 29 percent in January 2003. In 2003, ethanol-blended gasoline had a 49 percent market share in South Dakota produced by 7

[1] Montana consumed 498,845,225 gallons of gasoline in FY 2005 decreasing to 494,994,286 gallons in FY 2006 (MDT FY 2005 and 2006 tax reports). An estimated 30,211,161 gallons of ethanol blend were used in Montana in FY 2005 with another 6,058,799 gallons exported. FY 2006 estimates showed 30,049,906 gallons of ethanol blend used, with 11,159,993 gallons of E10 exported from Montana.
Montana Department of Transportation fuel tax records, FY2002 and FY2003, Bob Turner and "Understanding Energy in Montana", DEQ Report for the EQC, Oct. 2004..

[2] EPA Office of Transportation Air Quality, September 2004, and Renewable Fuel Association web site, December 2006.

operating ethanol plants[3]. A primary reason that there is so much ethanol production in the Dakotas is that ethanol plants provide an excellent market for surplus corn grown in those states. Also, North Dakota launched a large consumer education campaign to promote ethanol and as January 2007 has three operating plants, with a fourth to start by late spring[4].

Montana's demand for fuel ethanol is estimated by DEQ (using MDT tax records) to be 3.3 million gallons in FY 2005 and 3.8 million gallons in FY 2006. The increased demand for ethanol in FY 2006 appears to have been from the increases in exported ethanol blended gasoline to the greater Yellowstone area. This is due in part to 13 stations in the greater Yellowstone area carrying E10 as of FY 2006, and to Holiday gas stations carrying E10 as their mid-grade fuel at all stations.

Ethanol blends in Montana range from 8 to 85 percent ethanol (range from E8 to E85), with the 8-percent blend being the largest selling blend in-state during the Missoula winter 'oxy-fuel' season. All stations in Missoula sell a gasoline blended with ethanol from November 1 through February 28 each winter to meet certain air quality standards[5]. The Missoula area used 19.77 million gallons of ethanol blend fuel in FY 2005 increasing to 23.33 million gallons in FY 2006.[6] Thus, an estimated 65-80 percent of all ethanol blended gasoline in Montana is sold in the Missoula area in a given year.

About 50 gas stations across the state sell ethanol blend on a year-round basis, and most of this is E8 and E10. E85 is sold in at least one location in Montana (Malmstrom Airforce Base). E85 is a generic term for gasoline blends containing up to 85 percent fuel ethanol, with winter and summer blends much like regular gasoline. Only flexible fuel vehicles can use E85, whereas almost all vehicles on the road today can use E10, E8, or a lower blend. Over 20,000 flex fuel vehicles are registered in Montana capable of using E85 blend[7]. DEQ estimates from MDT records that less than 15,000 gallons of E85 were used in Montana in FY 2006.

Ethanol is not currently produced in Montana[8]. Ethanol sold in Montana is imported into the state and is usually splash blended with gasoline at distribution bulk terminals. So far, one refinery and terminal have installed a mechanical injection system for blending E10 ethanol blend in Montana. Montana's four refineries provide almost all of the gasoline consumed in Montana. Gasoline exported from Montana refineries usually does not contain ethanol. If ethanol is

[3] Montana Petroleum Association State Level Ethanol Mandate White Paper (October 2004).
[4] Kim Christianson, North Dakota State Energy Office.
[5] DEQ SIP maintenance plan for Missoula
[6] Missoula City/County Health oxygenated fuel distributor reports for FY 2005 and FY2006.
[7] Department of Justice, Motor Vehicle Division, VIN#
[8] Montana Microbial Products LLC, Missoula, operates a pilot plant in Butte that produces ethanol, but they have not refined it into fuel ethanol, although they recently acquired the equipment to do so.

added to Montana's exported gasoline, it is done in the destination state that receives that gasoline.

Table 1 shows the number of gallons of ethanol blend gasoline used in Montana, total taxed gasoline use, additional gallons of ethanol blend exported, and total demand for fuel ethanol in FY 2005 and FY 2006.

Table 1. Montana Ethanol Blend Use and Export

	FY 2005	FY 2006
Montana ethanol blended gasoline use (gallons)	30,211,161	30,049,906
Total Taxed Gasoline use (gallons)	498,845,225	494,994,286
Percent ethanol blend gasoline use to total gasoline use	6.06%	6.07%
E-10 Blended gallons exported	6,058,799	11,159,993
Fuel ethanol demand for ethanol blend gasoline use and export	3,300,490	3,804,765

Source: Montana Department of Transportation (MDT) for E10 and E85, the Missoula City/County Health Department (MCCH) for E8, and DEQ calculations.

Effect of Increased Ethanol Consumption on Montana Gasoline Consumers.

This section discusses the economic effects on gasoline consumers that would occur if a significant percentage of gasoline sold in Montana contained fuel ethanol. Before estimating these effects, we first estimate the amount of total fuel ethanol that could plausibly be consumed in Montana under future conditions.

The amount of taxed gasoline used in Montana in FY 2006 was 495 million gallons and was a similar amount in previous years[9]. A conservative estimate for average annual Montana gasoline consumption the next 10 years would therefore be 500 million gallons. Assuming in the future that all Montana gasoline consumed in the state contains an average 10 percent ethanol blend or E10, then 50 million gallons of fuel ethanol would be needed annually in Montana. If 40 million gallons of ethanol is produced in Montana triggering the mandate that requires E10 in all Montana gasoline (MCA 82-15-121 passed in the 2005 Session), then the 50 million gallon figure would be the best estimate of what would be needed to supply Montana's needs. This plausible 50 million gallon number for annual Montana fuel ethanol consumption in the foreseeable future is far greater than the 3.8 million gallons of fuel ethanol used annually today in-state. This estimated number would be expected to rise over time with increasing gasoline consumption, increasing market penetration of ethanol, increasing gasoline blends higher in ethanol than 10 percent (e.g. 50-85 percent ethanol blends or E85), and increasing consumer education about the benefits of ethanol.

[9] "Montana Department of Transportation tax summary report, FY 2006.

Montana gasoline consumers could potentially be affected by ethanol-blended gasoline if the price they pay at the pump changes[10]. Today, the retail price at the pump in Montana of ethanol-blended gasoline is generally the same as regular unleaded gasoline, even with its higher octane rating than regular grade. As anecdotal evidence, at the Holiday gas station in Helena, they are selling 89 mid-grade with 10% ethanol at the same price as the low grade 85.5. Thus, there is currently no direct economic impact on gasoline consumers today who buy ethanol blends. Gas stations compete fiercely on price, and will likely try to keep ethanol-blended gasoline competitive with non-ethanol gasoline in the near future. On the other hand, gas station owners would likely not hesitate to take any premium available for ethanol blended gasoline, and might not pass any available savings on to customers. Thus, gas customers should not see more than a few cents per gallon difference in either direction between ethanol and non-ethanol blends in the future. In other words, there should be little economic effect on gasoline customers from the increased penetration of ethanol into Montana's market. In comparison, the EPA mandate to lower sulfur gasoline in 2006-2007 and again in 2010, will create a 3 to 5 cent per gallon increase at the pump on average. Also, world oil prices have a far greater effect on gas prices than ethanol, as was seen in 2004 and 2005, when gas prices rose more than $1.00 per gallon over historical levels.

Several federal tax credits help keep ethanol blend gasoline competitive, because the price of fuel ethanol is historically greater than the price of gasoline. Currently, the rack terminal price for fuel ethanol in the U.S. ranges between $2.30 and $2.50 per gallon. Using Denver's rack prices as a baseline, Montana's fuel ethanol rack prices likely are about $2.35 per gallon currently as of January 2007[11]. The rack terminal prices in the U.S. vary currently by as much as $0.20 per gallon depending on the location of the terminal[12]. The average retail gasoline price in Montana as of January 2007 is $2.32. Subtracting about 46 cents per gallon in state and federal taxes (18.4 cents federal, 27.0 cents Montana taxes, and 0.75 cents for cleanup), would put average in-state rack gasoline prices at around $1.80 per gallon. So, there is currently a difference of about 55 cents per gallon comparing fuel ethanol to gasoline in Montana. The 51 cent federal credit makes up most of that difference.

The amount of ethanol blended with gasoline, and the tax incentives provided need to be considered for a final comparison of price effects on gasoline consumers. For E10, the price premium over non-ethanol blended gasoline would be 5.5 cents per gallon (10% of 55 cents). As of January 2007, this

[10] Montana gasoline consumers include just about everyone who drives in Montana or the vast majority of the adult population. Drivers of diesel vehicles are not included. The Clean Air Act Amendments require all cars sold in the US since 1978 to be able to use all legally blended oxygenated fuels, including a 10 percent blend of ethanol. Most off-road vehicles that also use gasoline like boats and snowmobiles are able to use ethanol blend.

[11] Biofuel Age, December 21, 2006.

[12] Renewable Fuel News, Hart Energy Publishing, December 20, 2005, Vol. XVI, No. 50, page 11.

premium appears to be offset in Montana by various federal tax credits on ethanol (including the federal ethanol producer incentive of 51 cents per gallon or 5.1 cents per gallon of E10[13]), and a volumetric tax credit to blenders of about 10 cents per gallon of E10. Montana's 15-percent reduction of state excise tax on mechanically injected E10 reduces Montana ethanol blend another 4-cents per gallon, thus making E10 competitive with gasoline for the consumer[14]. In other parts of the nation, the use of ethanol has actually lowered the price of gasoline such as in Chicago and Milwaukee during the summer of 2004.

Four factors in the future that will help keep ethanol blends price-competitive with non-ethanol blends in Montana include 1) the continuing Federal ethanol subsidy on ethanol set to expire in 2012[15], 2) an ethanol plant operating in Montana (which would lower transportation costs of ethanol that currently must be imported and might create market saturation that would lower prices), 3) continuing technological development to improve ethanol production, and 4) cost savings nation-wide from economies of scale as more ethanol is produced.

Car performance should not be significantly affected by ethanol. Vehicle mileage from E10 could either decline or increase slightly from using ethanol-blended gasoline. The change would likely be insignificant. However, vehicle mileage using E85 in Flex Fuel Vehicles (FFV) could be noticeably lower due to the lower energy content of ethanol as compared to gasoline. Little economic effect is expected to Montana gasoline consumers if ethanol further penetrates Montana's market, unless a lot of drivers start using E85.

Effect on Montana Refineries and Gasoline Retailers

The refining industry in Montana would bear some costs from increasing ethanol usage in-state, but would likely not be significantly affected in the long run. The main costs would include displaced market share for Montana produced gasoline products, and costs for purchasing ethanol blending equipment. There are several reasons why costs would not be prohibitive in the long run. For one, ethanol is an additive added after the refineries have produced their main gasoline product, so the main workings of the refinery would not be affected. Secondly, some of the gasoline distribution infrastructure already exists in Montana to handle the blending of ethanol for select or regulated markets, covering over 40 percent of the population.

For example, ethanol delivery facilities already exist in Billings (for the Yellowstone market), Bozeman, Glendive, various eastern Montana locations,

[13] http://www.eia.doe.gov/oiaf/analysispaper/biomass.html

[14] Only 45.01 percent in FY 2005 and 42.4 percent in FY 2006 of all ethanol blend received this incentive as much was splash blended or less than 10-percent (MDT tax records and MCCH report).

[15] This subsidy is the Volumetric Ethanol Excise Tax Credit signed into law by President Bush in October of 2004 at 51 cents per gallon, Renewable Fuels Association web site, search VEETC.

and Missoula (for winter use)[16]. In addition, other states served by Montana refineries are already mixing ethanol with a large portion of their gasoline, and the refineries there have adjusted to meet their changing specifications. In other words, adjusting to ethanol is quickly becoming the cost of doing business in the refining industry. The CHS (CENEX) refinery in Montana already has two ethanol blending facilities, Laurel and Glendive, at their bulk terminals in Montana. The cost per facility for the injection system is estimated at $200,000. In addition, storage tanks cost additional money and are estimated at $1.00 per gallon capacity to construct.[17].

Available evidence suggests that ethanol blend does not cost refineries any more to produce than other reformulated gas alternatives. In fact, it may cost less. The Renewable Fuels Association, a leading ethanol trade association headquartered in Washington DC, has released a study analyzing the refiner fuel costs during the transition from MTBE to ethanol. In every scenario examined, ethanol use reduced refiner costs compared to reformulated all-hydrocarbon gasoline. Reductions in refiner input costs ranged from 0.6-2.4 cents per gallon in that study. The cost reductions were a result of the ethanol blend needing less hydrocarbons per gallon produced than the other alternatives[18]. Current subsidies on ethanol also played a role in lower costs. In California, ethanol blend gasoline refining costs have been 3 cents per gallon less on average than gas blended with MTBE[19]. The 2005 Montana Legislative Session passed SB131 which banned the use of MTBE. Therefore, the refineries in Montana are well underway of implementing a process for ethanol blending.

Refinery distribution costs could initially be more with ethanol penetration into the market. With more ethanol consumed, refiners and pipeline terminals would be required to engineer, install and pay for delivery modifications to deliver ethanol, which would entail additional costs. Also, to meet vapor pressure requirements, ethanol-blended gasoline in the summer might need to be formulated with lower evaporative properties than gasoline that is to be sold for direct use[20]. This could add some cost as well. Retailers and distributors would need to change some of their procedures and educate their employees on how to handle the ethanol blend. Also, ethanol must be transported by rail car and tanker trucks to bulk terminals, which could cost more than using the pipelines which transport a majority of gasoline in Montana today. Due to quality problems that can occur if ethanol is pumped through pipelines that have transported petroleum products, neither ethanol or ethanol blended fuels can be pumped through the same pipelines used for petroleum products. However, these costs do not appear to

[16] Story Distributing, Conoco/Phillips Bulk Plant, Yellowstone Park Concessions Office, Montana Department of Transportation Fuel Tax Section records.
[17] Tom Harm, Cenex, cited in a personal email from Shirley Ball, EPAC, December 9, 2004.
[18] "Replacing the Volume & Octane Loss of Removing MTBE from Reformulated Gasoline: Ethanol Versus All Hydrocarbon RFG" prepared by Downstream Alternative. The RFA study was found in The Clean Fuels and Electric Vehicles Report, Energy Futures Inc., Vol 16, No. 3, September 2004.
[19] California Ethanol Workshop, presentation by California Air Resource Board, April 2003
[20] Montana Petroleum Association State Level Ethanol Mandate White Paper (October, 2004).

be prohibitive to the gasoline industry in other states. California, for example, banned MTBE in January 2004, and has been using ethanol ever since without supply disruptions or increases in cost greater than their other "boutique" fuel requirements (e.g. the recapture of refueling vapors, low benzene, aromatic content etc.).

There could be another cost to Montana refiners from increased ethanol blend displacing in-state demand for the gasoline refined in Montana. Using the ethanol consumption estimates made in the previous section, up to five percent of Montana's total refined gasoline would be displaced with ethanol. The five percent displacement number assumes that 100 percent of Montana gasoline in the future contains a 10 percent blend of ethanol, and takes into account that less than half of what refineries produce is consumed in-state. Refineries would likely make up the five percent or less market displacement by selling more fuel to out-of-state markets. However, additional transportation of that displaced gasoline being exported could make that portion of gasoline sold less profitable than under current conditions, thus resulting in another cost for industry.

It appears that the costs to Montana's petroleum industry, including refineries and distributors, would not be any more prohibitive than those associated with meeting other standards that have occurred in past years. Past federal regulatory costs have been significant in the short-run to Montana's gasoline industry, yet Montana's refineries have continued to operate, with no hints of permanent plant shut-downs. The same is assumed for continued ethanol penetration. Longer-term costs, if any, would likely be absorbed by refineries, or passed on to consumers in the form of slightly higher gas prices. About 50 retailers in Montana are already selling ethanol blends so it is clearly not cost prohibitive to retailers. The use of E85 blends does incur additional costs for replacement of various dispensing equipment and reduction of static electric discharge.

Economic Effects of Growing and Producing Ethanol in Montana on the local economy

An ethanol plant operating in Montana would create significant local economic benefits at the town and county level, plus some additional tax revenue at the state level. It would create benefits to farmers who provide the grains for such a plant.

An ethanol plant and/or farmers growing ethanol feedstock would be well suited for Montana's economy. Montana already grows the crops needed for ethanol production--mainly wheat, barley and corn. The economic impacts from ethanol production in-state would benefit Montana's rural economy with primary, secondary and supportive jobs and industry as well as additional income and tax revenues. It would also be one of the few Montana industries that would produce

and potentially export a value-added, finished product (as opposed to the many raw materials Montana currently produces and exports), and would create positive secondary economic impacts in state. Because of its value-added properties, ethanol would increase the economic value of Montana's agricultural sector, although the total percentage increase in value could be small overall compared to the entire agricultural sector. Ethanol is potentially a growth industry that could attract additional capital to the state for investment in ethanol plants construction. The effects on Montana's agricultural sector will be discussed in the next section.

As of December 20, 2006 ethanol is being produced in the U.S. at approximately 110 plants (with 63 under construction and 8 expansions) with a total capacity 10 billion gallons[21]. U.S. plants produced over 5 billion gallons of ethanol by mid-August 2006, at a rate of 329,000 barrels per day. Growth is occurring quickly nationwide[22]. The average size of currently operating plant facilities in the U.S. is about 40 million gallons per year (MGY) of ethanol[23]. A large ethanol plant can produce over 100 MGY. A 40 MGY plant would likely produce most or all of Montana's ethanol needs in the coming years. There will be a growing market for ethanol that could be produced in Montana and exported because of the strong national demand.

As of January 2007, there are no ethanol plants in Montana. A number of smaller plants operated in Montana from 1980-1995. The first ethanol plant in Montana began in Ringling in 1980. That same plant ended all Montana ethanol production in 1995. Since then, fuel ethanol production technology, higher petroleum prices, and improved management practices have greatly improved. Ethanol plants currently are successful in many small rural states. The greatest annual ethanol production in Montana was 4.95 million gallons in 1985 from five plants[24]. Proposed facilities as of December 2006 would produce that much in a month. In fact, all currently proposed ethanol plants in Montana are sufficiently large to capture economies of scale in production.

Currently, the Montana Department of Transportation has five ethanol production plants on their advanced producers list proposed for locations in Montana. Two of the most promising ethanol plants for Montana appear to be proposed for Hardin and Box Elder. The keys to success for an ethanol plant in Montana include sufficient financing, cost-effective grain supplies, effective management, strategic partners, affordable transportation for the grain, co-products from ethanol plants, and sufficient markets for plant co-products.

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[21] Renewable Fuels Association web site.
[22] RFA Ethanol Report #248, November 6, 2006 reporting numbers from EIA. "Ethanol Report 213", page 3, Renewable Fuels Association dated November 8th, 2004. Accessed December 21, 2006 on the Web at www.ethanolrfa.org/ereports/er110804.html .
[23] "Ethanol and the Local Community", by John Urbanchuk of AUS Consultants and Jeff Kapell of the SJH & Company, June 20, 2002 found at http://www.ncga.com/ethanol/pdfs/EthanolLocalCommunity.pdf .
[24] Montana Department of Revenue records of distributor and producer incentives paid.

There are several state level incentives that encourage ethanol production in Montana. One involves a reduction in the state motor fuels tax collected on ethanol blends until ethanol production begins in Montana. Another involves a 20-cent per gallon incentive to the ethanol producer using Montana agricultural products. Both incentives are subject to numerous limitations and restrictions[25]. Other incentives passed in the 2005 Montana Legislative Session include redefined tax incentives for the production of alcohol, a reduction in property tax for manufacturing machinery, fixtures, equipment, and tools used for the production of ethanol, and a tax credit for equipment and labor costs incurred to convert a motor vehicle licensed in Montana to operate on E85 alternative fuel[26].

Using economic figures from available ethanol case studies, a 50 MGY ethanol plant in Montana would create an estimated 40-50 permanent jobs, $3 million in annual additional wage income, additional annual tax revenues and a one-time boost of up to $140 million to the local economy during plant construction[27]. These are conservative figures and do not include positive secondary effects from plant operations, including increased local business and local equipment purchases by the plant. All of the case studies viewed suggest that the jobs in such a plant would above average wages and that such a plant would buy some of its needed inputs locally. If a larger plant or more than one such plant was built in Montana, then these benefit numbers would increase accordingly.

An ethanol plant built in Montana would likely run on at least some wheat and barley versus many plants in the Midwest that use solely corn. Wheat plants, however, have significant economic disadvantages compared to corn plants due the premium value of wheat relative to the value of corn and barley. For processing wheat, and especially barley, there are increased costs for grinding, pumping, enzymes, and lower ethanol yield per bushel.

Philip Madson, President of KATZEN International, Inc. explains that site selection for where to build an ethanol plant is based upon feedstock price and availability, investment costs, thermal and electric energy costs, water availability and access to co-products markets. Co-products from ethanol plants include distillers dried grains with solubles, wet distillers grains, and condensed distillers solubles. Mr. Madson goes on to state that decision of what feedstock (type of grain or plant matter) to use to produce ethanol is based primarily upon feedstock (starch) price and availability. However, there is the additional factor of increased investment in a wheat plant that is typically 5 to 10 percent more than

[25] Montana 2005 Legislative Session SB 293. .

[26] The equipment conversion incentive may be useful in the near future as EPA approves conversion kits for E85. Currently, none are approved, so the incentive is not now useable(EPA OTAQ web site, accessed August 28, 2006).

[27] Ethanol studies researched include, "Economic Impact of Ethanol Production Facilities" by ENERGETICS and the NEOS Corporation (June 1994), "Fuel Ethanol-A Technological Evolution", by NOVOZYMES and Brian and Brian International, (June 2004) and "Ethanol and the Local Community", by John Urbanchuk of AUS Consultants and Jeff Kapell of the SJH & Company, (June 20, 2002).

for a corn plant, and up to 40 percent more for a barley plant with an identical business model. Mr. Madson notes that the additional cost for building a wheat ethanol plant is less than the capital cost variation among the different types of corn ethanol plants[28].

Philip Madson goes on to state that the two factors that dominate the competitive positions of ethanol plants in the U.S. are first, feedstock cost, and second, state financial support for the producers. Other matters such as feedstock differences and technological factors that influence investment and cost-of-production are of marginal significance in comparison. Therefore, if the cost per ton of starch from Montana grain sources can compete favorably with the cost per ton of starch from Midwest corn, then Montana ethanol plants will be competitive (assuming comparable state support). If, however, the cost per ton of Montana starch compares unfavorably to Midwest corn, alternative support structures must be considered. Mr. Madson also mentions that other ethanol plants around the world use a variety of feedstocks based on these factors. Thus, it seems clear that many factors would go into the decision of whether or not and where to build a wheat or corn plant in Montana[29].

Effects of Producing Ethanol in Montana on the Agricultural Sector

Ethanol production in Montana would provide an additional market for certain Montana grain growers, particularly wheat, barley and corn growers. It would also provide a market for grower's off-specification or low quality grain. This would help both large and small farms in Montana. The wheat and barley grown in Montana provide as many opportunities for ethanol production as corn. However, price will be a driving factor. The price and availability of corn in the Midwest has greatly contributed to the growth of the ethanol industry. Currently, corn prices are about $3.84 per bushel, feed barley about $2.50 per bushel, and wheat is $5.14 per bushel[30]. Barley and wheat crops are more common in Montana than corn. Such production would potentially increase the demand for local agricultural products and possibly raise crop prices, which could increase farmer's net income. Ethanol production may change market dynamics for Montana crops. For example, Montana farmers typically sell wheat that is delivered to Washington, Oregon, and Idaho for foreign export, but the Puget Sound and Portland areas might purchase millions of gallons of Montana-produced ethanol, made from Montana crops

Increased ethanol production in-state could slightly shift the mix of crops on Montana agricultural land. Other markets, such as markets for oilseeds to be

[28] Letter to Ms. Shirley Ball from Philip W. Madson, President of KATZEN International Inc., dated December 8, 2004 and a letter to Brian Spangler, Montana Department of Environmental Quality from Philip W. Madson dated January 5, 2005.
[29] Ibid.
[30] http://www.quotemarkets.com/agricultural.html?gclid=CIie0cbZsIkCFQMRYQodZCoIMw and http://econ.sdstate.edu/Extension/corn.htm accessed November 2006.

used for biodiesel production could affect the crop mix in Montana. Ultimately, the crop mix in Montana will be based on which markets and crops are most profitable to farmers. Off-specification grain that is currently going to feed markets could be used instead for ethanol production. Off-specification wheat, for example, often has a low amount of protein compared to premium grain which suits ethanol production well because low-protein wheat has higher levels of starch. Enough off-specification grain is produced each year in Montana (1 to 3 percent of Montana's total crop) to supply at least a 50 MGY ethanol plant if transportation costs were favorable. In 1985, Montana's lowest crop yield in 75 years, 1.5 percent of the total wheat crop would have produced about 56 million gallons of ethanol[31]. That does not mean that all distressed grain would go to ethanol production. The distillers grains that do go to ethanol production could still be used for animal feed after being processed for ethanol, thereby reducing or avoiding cost impacts in stock growers.

The extent to which a Montana ethanol plant would raise crop prices statewide, if any, is unknown, although price increases in local regions of other states as a result of an ethanol plant have been documented[32]. In addition, ethanol plants can use distressed, low-quality grain, thus providing markets for a product that would otherwise command a low feed price. Every new ethanol plant has an impact on local corn prices and corn movement. The extent depends upon location, distance from the plant, and crop season. Most studies project a 5-10 cent per bushel increase for corn, with a documented increase of about 25 cents per bushel in eastern South Dakota where ethanol production has outgrown local corn supplies. The Dillon ethanol plant, when it was operating in the late 1980's, paid wheat producers 5 to 10 cents more per bushel over the price paid at the elevator[33].

Any rise in price might be insignificant since grain prices are typically determined on a national level. For example, grain prices are very high right now compared to just a few years ago. Thus, it is unclear whether Montana farmers would make more money for their crop by selling it to an ethanol plant. Impacts on Montana grain prices, if any, may be better estimated when the ethanol plant in Williston, North Dakota, begins production. At the present time, it is anticipated that 200,000 bushels of Montana-grown grain will be contracted with that plant[34].

In order for an ethanol plant to be successful and command an acceptable rate-of-return on investment, Montana would need to have a sufficient market for the by-products of an ethanol plant. These co-products include animal feed or high protein wheat gluten. These co-products could also generate value and income

[31] "Energy From Montana Crops and Residues", Montana Department of Natural Resources and Conservation, 1987.
[32] Nebraska Ethanol Commission, 2002.
[33] SW Montana Alcohol Plant Report, December 1986.
[34] Dr. Jerry Bergman, Board member of the ethanol plant in Williston, ND. Personal communication, November, 2004.

for Montana's agricultural sector.

Other Economic Effects from Producing Ethanol and Increasing Ethanol Use in Montana

Increased ethanol blend use in Montana would create other benefits that have not yet been discussed. Most of these benefits would be environmental in nature, and could extend beyond state borders. In some cases, the benefits are modest, but they are real. It is beyond the scope of this paper to estimate the magnitude or monetary values of these benefits, but the benefits themselves are listed here and include the following:

- Ethanol is biodegradable. Using ethanol as a gasoline oxygenate rather than MTBE could reduce or stop the water contamination and associated remediation costs in Montana that can occur from MTBE.
- Ethanol blend gasoline produces lower emissions of carbon monoxide, unburned hydrocarbons, volatile organic compounds, and fine particulate exhaust products than conventional fuels[35].
- Ethanol can increase the U.S. domestic energy supply. It takes only 1 energy equivalent unit of petroleum gasoline equivalent energy to produce 1.67 energy equivalent units of ethanol using today's technology[36].
- Producing ethanol fuel in the United States better ensures energy security, reduces the U.S. trade deficit, and reduces the need for securing Middle East oil.
- Increased air quality from cleaner burning fuel with ethanol provides the benefits of better air visibility, healthier ecosystems, and higher quality recreation.
- Ethanol may use materials that would typically go into the waste stream, thus reducing waste to make a valuable product. For example, ethanol production could assist in the disposal of paper mill waste sludge.
- Ethanol speeds up the gradual U.S. switch away from a fossil fuel economy by resulting in the use of less hydrocarbons from non-renewable resources. Using ethanol in all reformulated gasoline nationwide could contribute 5 billion gallons per year to the U.S. fuel supply[37].

As mentioned earlier, ethanol is currently subsidized in the U.S. Some look at subsidies as economic distortions, or as a transfer of money at best. Thus, the state and federal subsidies needed to make ethanol work today in the U.S. could be looked at as a cost by some parties. Within the past year, however, ethanol has likely become profitable without these subsidies.

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[35] Argonne National Laboratory, GREET Model 1.6, 2003.
[36] This figure is from the USDA, June 2004, as reported in "Net Energy Balance of Ethanol Production", Fall 2004, A Publication of Ethanol Across America, page 6.
[37] DOE EIA states 5-billion gallons were produced by August 2006, November EIA report on U.S. ethanol production.

Conclusion

The greater penetration of ethanol blend into Montana's gasoline market would produce insignificant benefits and costs on a state level in terms of major economic indicators. Benefits would be significant on a local level to select communities and farmers if an ethanol plant were built in Montana. These local benefits would include jobs, income, local tax revenue, secondary economic effects, and possibly higher prices to the crops of select farmers. The initial costs to the petroleum industry of switching to ethanol blend could be noticeable, although long-term industry costs would not be significant. The experience in other states shows that the long-term costs of switching to ethanol blend are eventually absorbed by the industry and are a part of the costs of doing business in a changing world. Gasoline consumers would experience no significant effects, and could see either a small rise or small fall in the gasoline prices they pay as well as vehicle performance. There would be a benefit to the environment in the form of both improved air and water quality, and thus to Montanans in general.

January 19, 2007